Copper Recovery from Spent Catalyst used in COSORB Processes

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Abstract

Environmentally responsible and sustainable waste management derived from technological processes represents an important priority marked by both national and EU legislation. Therefore, exploitation of chemical waste is considered as an obligation for each member state and, by default, for all the factors involved in the products life cycle and also an important economic opportunity.

The main objective of our research project is to reduce the environment pollution with heavy metals and aromatic organic materials by recycling spent catalyst complexes resulted from industrial COSORB processes. In addition, it is economically desirable to recover the metals, which are usually copper and aluminum, from waste materials. Therefore, the present study aimed to develop a process for recovering copper from spent solutions of complexing agents containing cuprous aluminum tetrachloride. The liquid sorbent consisting of bimetallic $CuAlCl_4$ in toluene and impurities has been subjected to several separation and analysis procedures for recovering and purification of metals and toluene. The process comprised of (i) treatment of spent solution with different solutions of sodium hydroxide, calcium hydroxide or water; (ii) separating the organic phase and the aqueous phase; (iii) contacting the aqueous phase containing the dissolved cuprous halide with iron, for precipitating copper metal and (iv) recovering the precipitated copper metal.

The separation method employing water showed the best performances in terms of operational simplicity and cost-efficiency. The organic phase after separation contained 84.5 % toluene as major component, 10.0 % toluene oxidation products, 5.4 % xylene, and 0.1 % benzene traces. The inorganic phase contained about 98.5 g/L copper, 40.1 g/L aluminum, 20.0 mg/L zinc, 26.0 mg/L chromium and 18.0 mg/L iron. The yield of copper metal recovered from the spent solution was 91.9 % with 99.35 % purity.

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